

Technology for Real-Time Measurement of Surface and Airborne Beryllium

Technology Need:

Personnel exposure to beryllium during clean-up activities or during material processing is a major health risk within the DOE, Department of Defense, and some private sector industries. Accurate and timely detection, and monitoring of beryllium is critical to worker safety during deactivation and decommissioning (D&D) activities. Beryllium dust is a significant workplace hazard. Exposure to beryllium particles can cause a serious illness in certain people. This illness is chronic beryllium disease, or CBD—an irreversible and sometimes fatal scarring of the lungs. Beryllium metal has been produced for various industrial uses, and was widely used in aerospace and defense applications. The baseline method for beryllium analysis is to send samples to an off-site laboratory for analysis. Results may not be available for days or weeks after sample shipment.

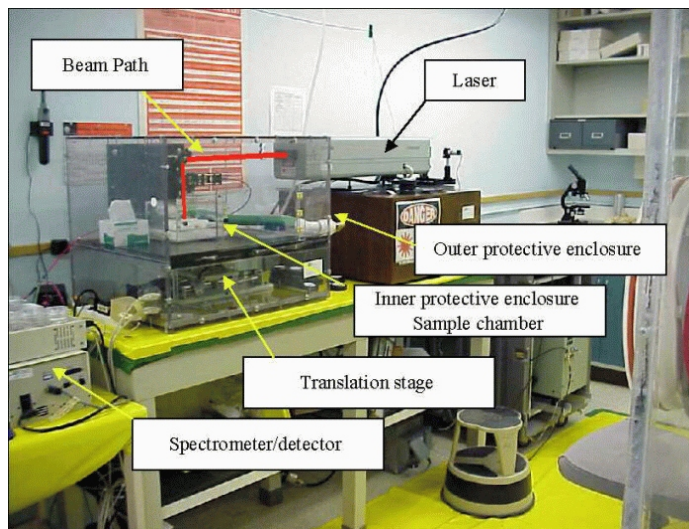
Technology Description:

Science & Engineering Associates, Inc. (SEA) is developing a multi-function beryllium monitor based on laser induced breakdown spectroscopy (LIBS). The instrument can be operated in two modes: 1) as a continuous air monitor (CAM), and 2) as an instrument to analyze swipes and other filter media-based samples. The monitor is designed to provide measurements of airborne beryllium to concentrations less than 0.2 micrograms per cubic meter, and measurements of surface contamination to less than 0.2 micrograms per 100 square centimeters. The CAM mode allows the operator to set up the system to run autonomously. The system will collect data over configurable set of filter samples, blanks, and spikes. The system will raise an alarm if beryllium is detected in the air at a concentration equal to, or above the pre-set alarm threshold. The general filter and swipe analysis mode utilizes the instrument

hardware to analyze previously collected beryllium-on-filter samples. Essentially, the only difference is that the sample acquisition (pumping step) is omitted.

Benefits:

- Provide rapid, in-the-field measurement results for airborne and surface beryllium contamination
- Fully automated operation in the CAM and wipe analysis modes, thereby reducing the labor costs and risk of worker exposure to beryllium associated with current sampling schemes



LIBS Prototype setup at Lovelace Respiratory Research Institute

Status and Accomplishments:

SEA is developing a technology for real time monitoring of surface and airborne beryllium. The Lovelace Respiratory Research Institute (LRRI) has prepared various beryllium on filter samples for SEA,

provided laboratory space at the LRRRI facility for SEA to conduct LIBS measurements of the beryllium filters, and provided consultation related to the design of the beryllium monitor.

SEA completed the design report incorporating input from Rocky Flats Environmental Technology Site (RFETS), Characterization, Monitoring and Sensor Technology (CMST) Crosscut Program, the D&D Focus Area, and other DOE EM-related personnel with expertise and experience in instrumentation and field measurements. The design report describes the system requirements, hardware design, control software design, and the approach taken for data analysis.

RFETS provided SEA with a set of filters that contained beryllium at the following concentrations (in micrograms): 0, 5.12, 10.2, 51.1, and 78. These samples were used to develop an LIBS calibration that is needed to perform quantitative analysis of unknown samples. SEA evaluated the samples, created a calibration model and performed predictions for the unknown samples. Results showed a clear correlation between the beryllium mass and LIBS signal.

Fabrication of the prototype was completed. SEA completed the demonstration of the monitor's swipe-mode at the Lovelace facility during the week of January 14, 2002.

SEA is awaiting guidance from DOE, specifically RFETS, to schedule delivery of the instrument to RFETS for operator training and demonstration of the instrument's continuous air monitor (CAM) function.

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Online Resources:

Office of Science and Technology, Technology Management System (TMS), Tech ID # 2914
<http://ost.em.doe.gov/tms>

The National Energy Technology Laboratory Internet address is <http://www.netl.doe.gov>

For more information on this and other technologies, please visit SEA's website at <http://www.seabase.com>